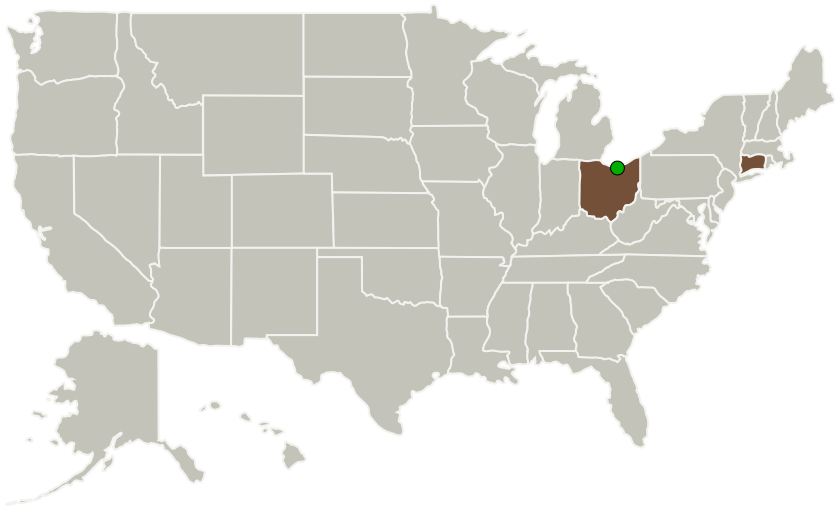
High Efficiency Advanced Lightweight Fuel Cell (HEAL-FC), Phase I

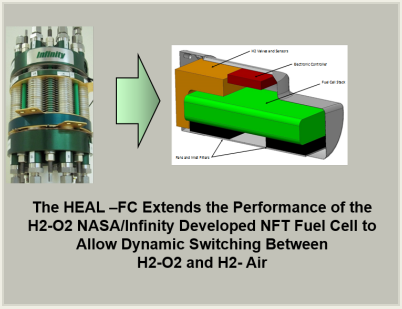
Completed Technology Project (2016 - 2016)

Project Introduction

Infinity's High Efficiency Advanced Lightweight Fuel Cell (HEAL FC) is an improved version of its current fuel cell technology developed for space applications. The fundamental operation of this Proton Exchange Membrane (PEM) fuel cell is improved over comparable fuel cell technologies, providing simplified system design and longer duration missions. The Non Flow Through (NFT) nature of reactant consumption within the fuel cell stack produces a much higher utilization of reactants. The Advanced Product Water Removal (APWR) embodied within each repeat element of the fuel cell stack allows for the elimination of the water separation devices usually residing in the balance of system. This drives system simplification while increasing overall reliability and reducing system cost. The HEAL FC can be operated as a hydrogen-oxygen fuel cell for long endurance missions and also as a hydrogen-air fuel cell. This transition from pure oxygen to air can be accomplished dynamically in flight, allowing for reduced mass of the oxygen storage subsystem. This is a critical advantage for UAS flying to and from dense air environments consuming air as the fuel cell oxidant and switching over to pure oxygen when in the dense air region of concern. The fuel cell stack improvements to be made as part of this topic are planned to make the fuel cell stack more amenable to Unmanned Aerial Systems (UAS) by reducing mass and volume. The current configuration of the fuel cell stack was driven by performance only. Now that the NFT and APWR technologies have been proven, the stack hardware itself must be minimized to fit the UAS markets. Costs for this advanced fuel cell system will inherently be reduced through the implementation of mass production design methodology to transform a well-functioning power system for space applications to lower altitude uses.

Primary U.S. Work Locations and Key Partners





The HEAL –FC Extends the Performance of the H2-O2 NASA/Infinity Developed NFT Fuel Cell to Allow Dynamic Switching Between H2-O2 and H2- Air

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Table of Contents

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Organizations Performing Work	Role	Type	Location
Infinity Fuel Cell and Hydrogen, Inc.	Lead Organization	Industry	Windsor, Connecticut
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Connecticut	Ohio

Project Transitions

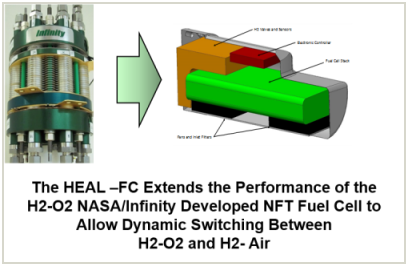
June 2016: Project Start

December 2016: Closed out

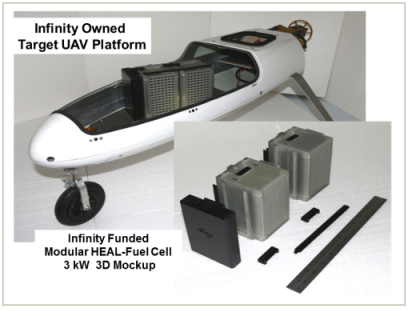
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139926)*

Images



Briefing Chart Image
High Efficiency Advanced Lightweight Fuel Cell (HEAL-FC), Phase I
(https://techport.nasa.gov/image/128675)



Final Summary Chart Image
High Efficiency Advanced Lightweight Fuel Cell (HEAL-FC), Phase I Project Image
(https://techport.nasa.gov/image/126197)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Infinity Fuel Cell and Hydrogen, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

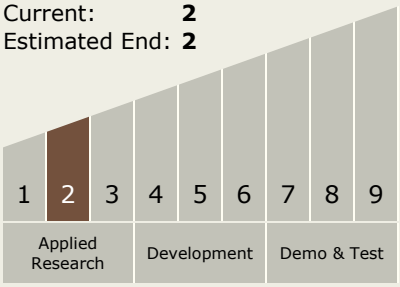
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
William Smith

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.2 Electrochemical: Fuel Cells

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System